REMARKS

Claims 21, and 25-38 are all the claims pending in the application. Claims 22-24 are canceled, above. In addition, new claims 27-38 are added, above, to further define the invention. An excess claim fee is being paid with this Amendment to pay for the excessive number of independent claims. Claims 21, 25, and 26 stand rejected on prior art grounds. Applicants respectfully traverse this rejection based on the following discussion.

I. The Prior Art Rejections

Claims 21, 25, and 26 stand rejected under 35 U.S.C. §102(b) as being anticipated by Rostoker (U.S. Patent No. 5,662,768). Applicants respectfully traverse this rejection based on the following discussion.

An important feature of the invention is the lateral mask patterning along different crystalline planes ([100], [111], etc.) of the substrate to create specific shapes within the sidewalls of the openings. For example, as shown in Figures 12A and 12B and as explained on page 11, lines 18-22, of the application, an isotopic etch is utilized to form the lateral openings 120 which are rectangular in cross-section. The openings 120 are rectangular in cross-section because the structure is aligned with the <111> plane. To the contrary, the same isotopic etching produces the V-shaped openings 121 shown in Figure 12B when the structure is aligned in the <100> plane.

To the contrary, Rostoker discloses a process for forming trenches having high surface-area sidewalls with undulating profiles. Such trenches are formed by first implanting multiple vertically separated layers of dopant in a substrate beneath a region where the trench is to be formed. Next, the trench is formed under conditions chosen to selectively attack highly doped substrate regions (i.e., substrate regions where the dopant has been implanted). The resulting trench sidewalls will have undulations corresponding to the positions of the implanted regions.

Such undulations are fundamentally different than the rectangular or V-shaped openings defined by Applicants' independent claims. More specifically, as shown in the drawings of Rostoker, only curved openings or curved recesses are formed. The claimed rectangular or V-shaped openings are advantageous when compared to the undulations of Rostoker because the claimed structures present a larger surface area, present a more precisely formed shape for better quality control, and present well-defined corners which can be used for higher levels of technology, such as vertical transistors.

Therefore, since Rostoker does not teach or suggest that the "lateral openings comprise rectangular openings in cross-section" independent claim 21 is patentable over Rostoker. Further, dependent claims 25 and 26 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. In view the forgoing, the Examiner is respectfully requested to reconsider and withdraw this rejection.

II. Formal Matters and Conclusion

In view of the foregoing, Applicants submit that claims 21 and 25-38, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary.

Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 50-0510.

Respectfully submitted,

Dated: 7/11/02

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Attachment

Marked Up Version of Changes Made:

21. (Amended) An integrated circuit having at least one trench capacitor, said trench capacitor comprising:

a substrate;

an opening in said substrate, said opening having vertical sides, said vertical sides including a plurality of lateral openings, wherein said lateral openings comprise rectangular openings in cross-section;

an insulator lining said opening; and

a conductor filling said opening.

Please cancel claims 22-24 without prejudice or disclaimer.

Please add the following new claims:

27. An integrated circuit structure comprising:

a substrate;

an opening in said substrate, said opening having vertical sides, said vertical sides including a plurality of lateral openings, wherein said lateral openings comprise V-shaped openings in cross-section; and

a conductor filling said opening.

28. The integrated circuit in claim 27, wherein said lateral openings increase a surface area of said structure.

29. The integrated circuit in claim 27, wherein said lateral openings increase a capacitance of said structure.

30. An integrated circuit structure comprising:

a substrate;

an opening in said substrate, said opening comprising a first rectangular portion and a second rectangular portion, wherein said second rectangular portion has larger dimensions than said first rectangular portion; and

a conductor filling said opening.

31. The integrated circuit in claim 30, wherein said second rectangular portion is deeper in said opening than said first rectangular portion.

32. The integrated circuit in claim 30, wherein said first rectangular portion is deeper in said opening than said second rectangular portion.

33. The integrated circuit in claim 30, wherein said lateral openings increase a surface area of said trench capacitor.

34. The integrated circuit in claim 30, wherein said lateral openings increase a capacitance of said structure.

35. An integrated circuit structure comprising:

a substrate;

an opening in said substrate, said opening comprising a first rectangular portion, a second rectangular portion, and a third rectangular portion, wherein said second rectangular portion has

larger dimensions than said first rectangular portion and said third rectangular portion; and

a conductor filling said opening.

36. The integrated circuit in claim 35, wherein said second rectangular portion is between said first rectangular portion and said third rectangular portion.

37. The integrated circuit in claim 35, wherein said first rectangular portion and said third rectangular portion have substantially similar dimensions.

38. The integrated circuit in claim 35, wherein said lateral openings increase a surface area of said structure.